W. J. Budzyna
49 Gill Court
Whitinsville, MA, 01588

September 27, 2013

Chief Michael Gauthier
Grafton Fire Department
26 Upton Road
Grafton, MA 01519

Re: Fire antenna attachment request for proposed tower at 104 Creeper Hill Rd, Grafton

Dear Mickey:

The Grafton Fire Department has an opportunity to add a component to its radio system to improve coverage in and around the Wyman-Gordon plant (W-G), which is a known dead spot for both receiving from and transmitting to the Pigeon Hill repeater. US Wireless, Inc./Vertical Bridge Development II, LLC is proposing to erect a 180' monopole tower for the use of up to four wireless carriers, for the purpose of improving their coverage in the area The site is located at 104 Creeper Hill Road which is about as far to the northwest in Grafton as you can go and is about 1/3 mile north of W-G.

The Fire radio system did not get the upgrade at the time of construction of the new Fire and Police stations about 10 years ago, at which time the Police radio system was completely replaced. The Fire system lacks a receiver voting system like the PD has, with receiver locations at Pigeon Hill, Brigham Hill, Tufts Veterinary School, and the South Grafton Fire Station, all of which offer very good coverage of the town. (Because of topography, the W-G area is also a poor coverage area for the PD). U.S. Wireless has offered the Town space above and below the wireless carrier area on the tower for the installation of any antenna that may be of benefit to Public Safety services.

To take advantage of this opportunity, I recommend that Grafton Fire Department be able to request the following from U.S. Wireless:

- Attach a dual-dipole directional antenna (Telewave Model ANT450D3-6) at the 100' level for use with a new receiver voting system to be retrofitted to the existing radio system to incorporate the advantage of this tower. This antenna is the same one that is being requested by WoRAD, Incorporated, for the Police Department, and will be shared with the PD.

- Attach a dual-dipole directional antenna (Telewave Model ANT450D3-6) at the 175' level for use with a future "steered" repeater which can be turned on by the Communications Dispatcher or the Fire Chief, to shift the working repeater transmitter from Pigeon Hill to this site for better building penetration of the signal. (This feature must wait until the repeater at Pigeon Hill is upgraded – which should not be considered to be a part of this project). The 175' level is recommended to ensure contact, if this repeater is being used for an incident at W-G, with responding trucks coming from South Grafton and the Center as they pass through the area from Koopman's to the 122/140 split. The antenna must also be spaced more than 20' vertically from the lower receiving antenna for sufficient isolation. Since this infringes on the cellular carriers' area, it must be mounted above them. This antenna can be shared with the PD if they need this feature in the future.

- Have space allocated on the tower at the 65' level to mount the area's warning horn mandated because of the G& U Railroad's propane transloading facility.

- Provide 2 outdoor equipment cabinets, placed side-by side or back-to back on a 9' x 6' concrete equipment pad, preferably near an ice bridge, with conduit runs for power and telco lines. The antenna cables should be 7/8" hardline, with one cable to each box. Standard industry site grounding methods should apply.

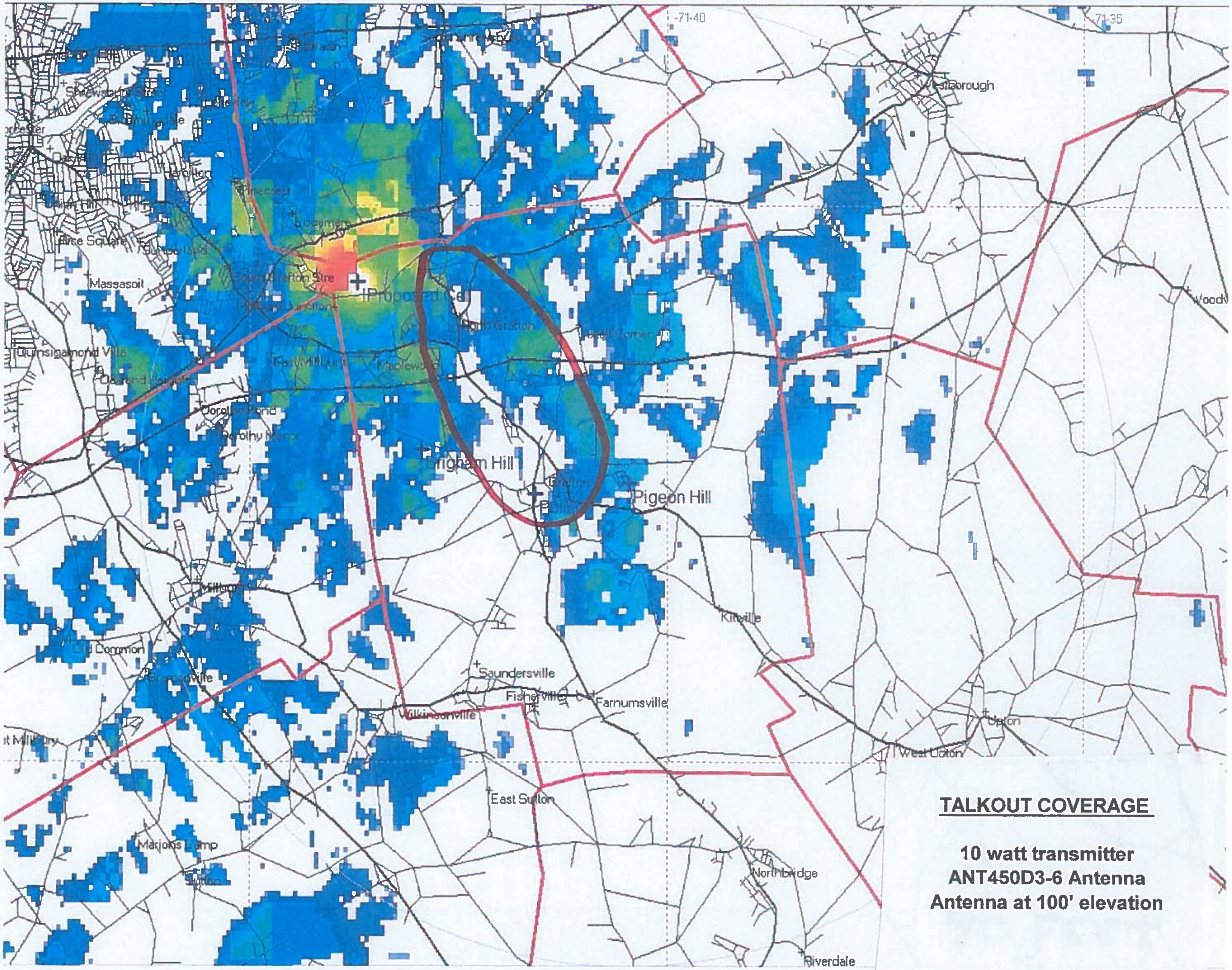
My understanding is that US Wireless, Inc./Vertical Bridge Development II, LLC will to perform the installation of the antenna equipment on the tower at the above specified heights and prepare the ground based equipment pads. Necessary antenna assembly data and azimuth alignments will be provided when the project is approved.

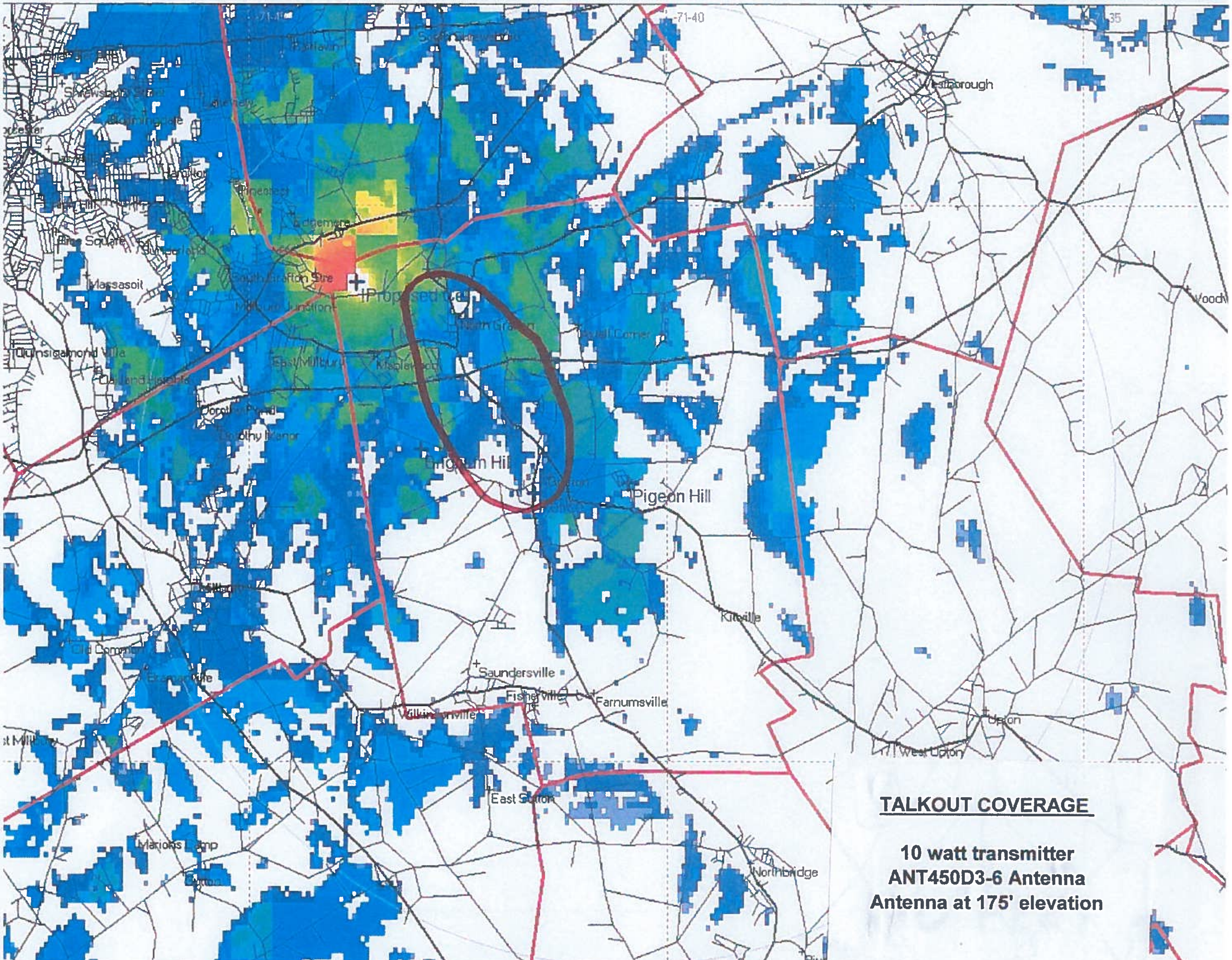
An equipment list has been furnished to WoRAD, Incorporated, to consolidate it with their list for the Police Department.

RF propagation plots of the specified antenna at the 100' and 175' levels have been included for comparison. The transmitter power was 10 watts and the antenna was the ANT 450D3-6 with a directional pattern aimed south. They appear to be identical, but the coverage on Rt. 140 above and below the Mass. Pike bridge is noticeably improved. This area is circled in red on the plots.

Regards,

Jim Budzyna


TALKOUT COVERAGE
10 watt transmitter
ANT450D3-6 Antenna
Antenna at 100' elevation
-71-40
-71-35
Westborough
Massasoit
Brigham Hill
Pigeon Hill
Saundersville
Fisherville
Farnumsville
Upton
West Upton
East Sutton
Northbridge
Riverdale


TALKOUT COVERAGE
10 watt transmitter
ANT450D3-6 Antenna
Antenna at 175' elevation
Pigeon Hill
Saundersville
Farnumsville
Kittville
Upton
West Upton
Northbridge
East Sutton
Massasoit
South Grafton Stre
Westborough

TELEWAVE, INC.

406 - 512 MHz

ANT450D, D3, D6-9

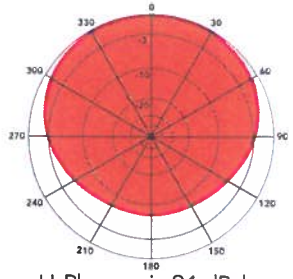
DIPOLE AND DIPOLE ARRAY 1 TO 9 dBd

The Telewave ANT450D series consists of single, dual, and 4-element dipole array antennas with a precision phasing harness for optimum performance. The antenna horizontal pattern is field-adjustable, for any current or future coverage requirements. The wide bandwidth and high efficiency of these antennas make them ideal for many applications, including trunking, business, public safety, government, and amateur radio.

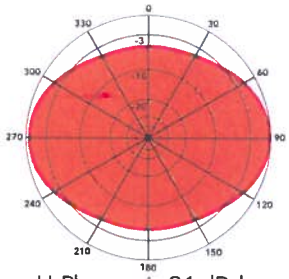
Each dipole element is constructed with 6061-T6 aluminum, and welded at the base for maximum strength. Each antenna is also completely sealed with our high-tech Txylan™ coating, which resists water and ice buildup, and provides exceptional protection from corrosive gases, UV radiation, salt spray, acid rain and windblown abrasives. The phasing harness is fully sealed by Telewave's Millenium Seal™ technology.

All components are at DC ground potential for lightning protection. Each dipole element includes a heavy-duty custom clamp set for mounting to a 1.5"-2.5" diameter galvanized steel support pipe or tower leg.

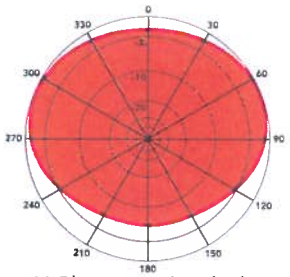
Up to 15 degrees of electrical uptilt or downtilt may be specified for D3 or D6-9 models. Desired tilt angle must be included on the order, and consultation with our antenna engineering staff is requested.



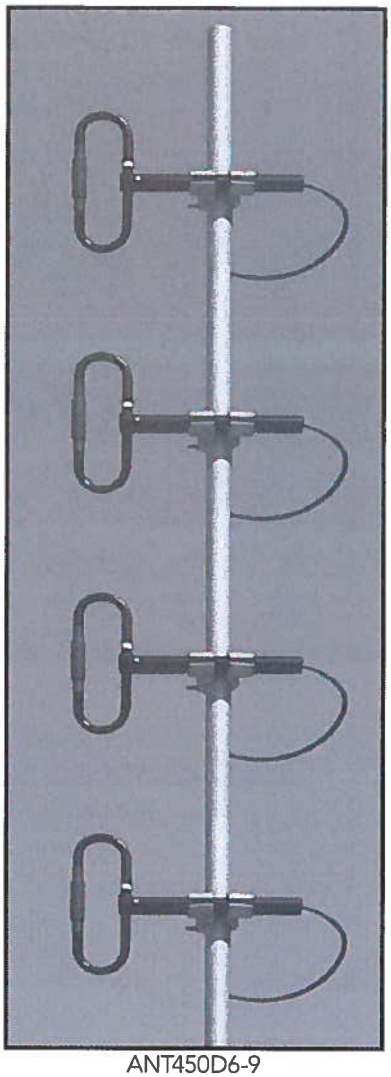
H-Plane gain 9.1 dBd
1/4 wl. spacing from tower



H-Plane gain 9.1 dBd
1/2 wl. spacing from tower



H-Plane gain 8.5 dBd
3/8 wl. spacing from tower



ANT450D6-9
(Harness not shown)
Support mast is
customer-supplied

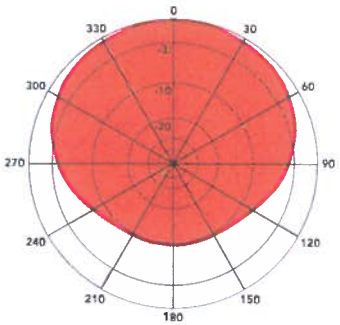
COMMON SPECIFICATIONS			
Frequency (continuous)	406-512 MHz	**Lightning protection**	DC Ground
Power rating (typ.)	500 watts	**Wind rating**	175 MPH
Impedance	50 ohms	**(with 0.5" ice)**	150 MPH
VSWR	1.5:1 or less		
Pattern	Adjustable: Offset circular, cardioid, or bidirectional		
Termination	N-Male or 7-16 DIN (opt.) on harness feed cable		

MODEL SPECIFICATIONS	ANT450D	ANT450D3	ANT450D6-9
Gain (dependent on pattern)	1-2.5 dBd	3-6 dBd	6-9 dBd
Vertical beamwidth (3/8 wl.)	71°	34°	15°
Dimensions (H x D) (max)	13 x 12 in.	31 x 12 in.	71 x 12 in.
Weight (antenna + clamps)	6 lbs	13 lbs	18 lbs
Maximum exposed area	0.27 ft.²	0.68 ft.²	1.4 ft.²
Lateral thrust at 100 MPH	11 lbs	28 lbs	60 lbs
Electrical uptilt / downtilt	N/A	1-15°	1-15°

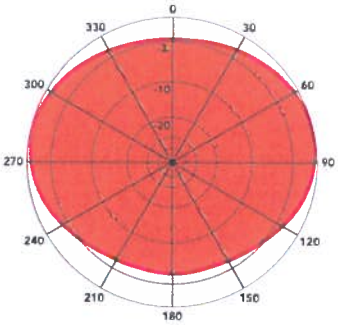
DIPOLE PATTERN ADJUSTMENT

Telewave folded dipoles are field adjustable to provide different horizontal patterns and gain values. The horizontal spacing from tower between the dipole and the support mast or tower leg controls this adjustment. Review the patterns below to determine which is best suited to your range area requirements. Use the chart on the next page to find the appropriate dimension for antenna to mast spacing. The drawing at the bottom shows how this measurement is made and the vertical spacing to be used for multi-element arrays.

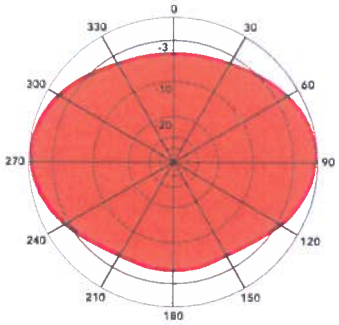
Horizontal radiation patterns



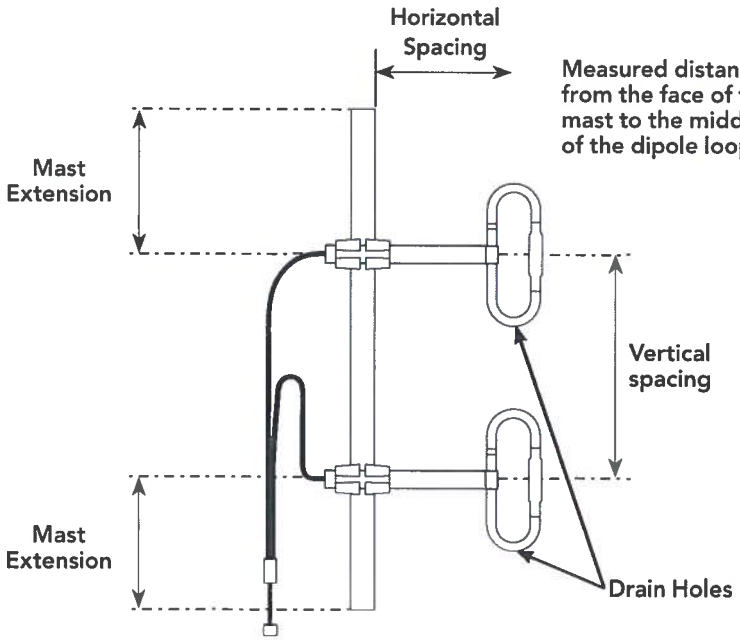
Offset Circular
1/4 wavelength spacing



Cardioid
3/8 wavelength spacing



Bi-directional
1/2 wavelength spacing



IMPORTANT: Be sure that <u>the drain holes are on the bottom</u> when the elements are installed.

TELEWAVE, INC.

300 - 1000 MHz

DIPOLE PATTERN ADJUSTMENT

DIPOLE MOUNTING AND MAST SPECIFICATIONS

Mast lengths shown are minimum acceptable lengths to insure proper pattern control. Mast extension is applied at top and bottom of array. Longer masts are acceptable, but the dipole or array must be centered on the support to prevent beam tilt. The clamps provided with the dipoles will work properly to attach the dipole boom to a mast that is between 1.5 to 2.5 inches in diameter. To attach to smaller supports (1-1.5" diameter), use ANTS420 shims. This allows direct mounting to small towers such as the Rohn 25 and 45.

MAST MINIMUM LENGTH AND ELEMENT VERTICAL SPACING (at midband)

ANTENNA	MAST LENGTH	MAST EXTENSION	VERTICAL SPACING	MINIMUM MAST TYPE
ANT350D	20"	10"	N/A	1.5" Schedule 40 Galvanized Pipe
ANT350D3	3'-7"	10"	23"	1.5" Schedule 40 Galvanized Pipe
ANT350D6-9	7'-5"	10"	23"	1.5" Schedule 40 Galvanized Pipe
ANT375D	16"	8"	N/A	1.5" Schedule 40 Galvanized Pipe
ANT375D3	3'-3"	8"	24"	1.5" Schedule 40 Galvanized Pipe
ANT375D6-9	7'-3"	8"	24"	1.5" Schedule 40 Galvanized Pipe
ANT400D	15"	7.5"	N/A	1.5" Schedule 40 Galvanized Pipe
ANT400D3	3'	7.5"	22"	1.5" Schedule 40 Galvanized Pipe
ANT400D6-9	6'-2"	7.5"	22"	1.5" Schedule 40 Galvanized Pipe
ANT425D	14"	7"	N/A	1.5" Schedule 40 Galvanized Pipe
ANT425D3	2'-11"	7"	21"	1.5" Schedule 40 Galvanized Pipe
ANT425D6-9	6'-5"	7"	21"	1.5" Schedule 40 Galvanized Pipe
ANT450D	13"	6.5"	N/A	1.5" Schedule 40 Galvanized Pipe
ANT450D3	2'-7"	6.5"	19.375"	1.5" Schedule 40 Galvanized Pipe
ANT450D6-9	5'-11"	6.5"	19.375"	1.5" Schedule 40 Galvanized Pipe
ANT450D7-12	12'-4"	6.5"	19.375"	1.5" Schedule 40 Galvanized Pipe
ANT500D	13"	6.5"	N/A	1.5" Schedule 40 Galvanized Pipe
ANT500D3	2'-7"	6.5"	17.5"	1.5" Schedule 40 Galvanized Pipe
ANT500D6-9	5'-5"	6.5"	17.5"	1.5" Schedule 40 Galvanized Pipe
ANT550D	12"	6"	N/A	1.5" Schedule 40 Galvanized Pipe
ANT550D3	1'-10"	5.5"	16"	1.5" Schedule 40 Galvanized Pipe
ANT550D6-9	4'-6"	5.5"	16"	1.5" Schedule 40 Galvanized Pipe
ANT750D	8"	4"	N/A	1.5" Schedule 40 Galvanized Pipe
ANT750D3	19"	4"	11.625"	1.5" Schedule 40 Galvanized Pipe
ANT750D6-9	3'-6"	4"	11.625"	1.5" Schedule 40 Galvanized Pipe
ANT900D	6.5"	3.25"	N/A	0.5" Schedule 40 Galvanized Pipe
ANT900D3	22"	4"	14"	0.5" Schedule 40 Galvanized Pipe
ANT900D6-9	4'-2"	4"	14"	0.75" Schedule 40 Galvanized Pipe

ELEMENT HORIZONTAL SPACING FROM TOWER (at midband)

MODEL NUMBER	1/4 wl. OFFSET CIRCULAR	3/8 wl. CARDIOID	1/2 wl. BI-DIRECTIONAL
ANT350D, D3, D6-9	8.4"	12.6"	16.8"
ANT375D, D3, D6-9	7.4"	11.1"	14.8"
ANT400D, D3, D6-9	6.9"	10.3"	13.7"
ANT425D, D3, D6-9	7"	10.5"	14"
ANT450D, D3, D6-9, D7-12	6"	9"	12.1"
ANT500D, D3, D6-9	5.4"	8.1"	10.9"
ANT550D, D3, D6-9	5"	7.5"	10"
ANT750D, D3, D6-9	3.7"	5.5"	7.3"
ANT900D, D3, D6-9	3.1"	4.6"	6.2"

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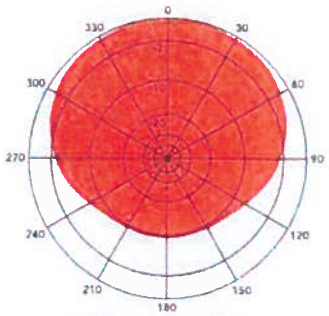
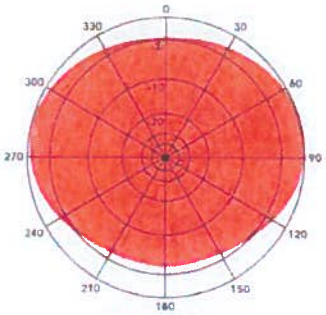
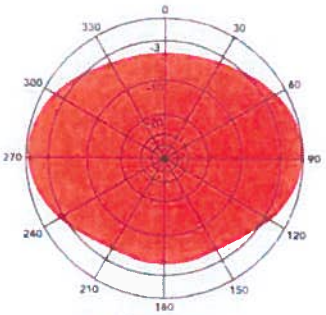


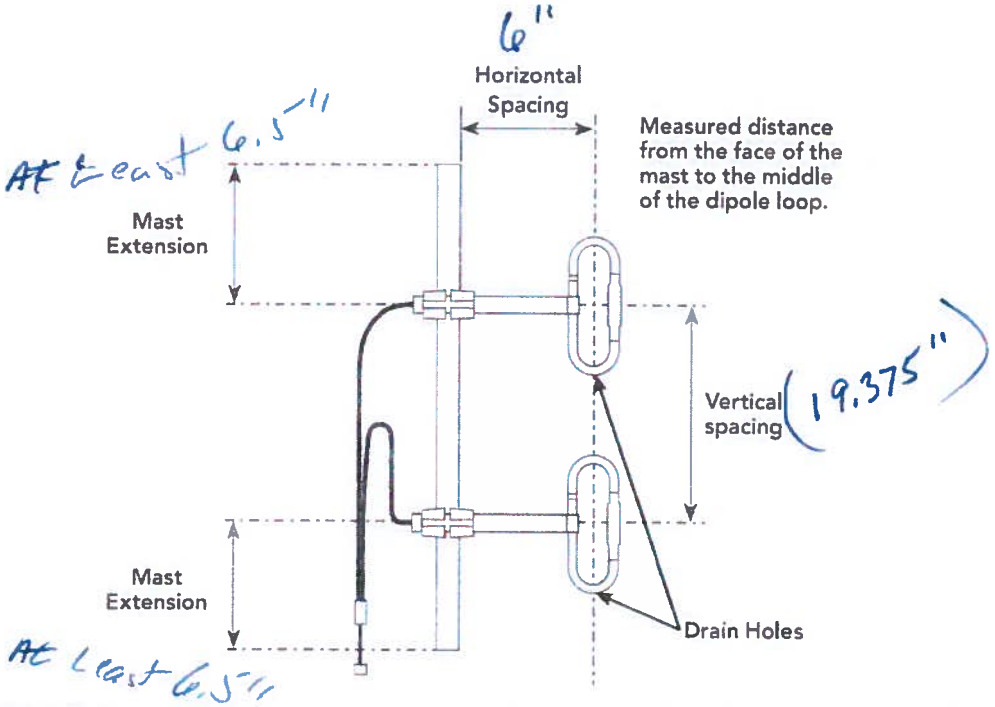
Offset Circular
1/4 wavelength spacing



Cardioid
3/8 wavelength spacing



Bi-directional
1/2 wavelength spacing



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